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ABSTRACT

This study examined the impact of different styles of parental communication and teaching on children's problem solving, focusing on how parental teaching and communication styles affected children's performance on four problem-solving games involving deduction/categorization and planning. Thirty-two children ages 4 and 5 years and their families from around the island of Oahu, Hawaii, participated in the study. Videotaped home visits consisted of an individual-play pretest, a parent-partner phase, and an individual-play posttest. The children played one deduction/categorization and one planning game with their parents. The study found that as parental metacognition instruction and strategic explanation increased, so did children's posttest scores compared to their pretest scores. Parents exhibited more metacognitive instruction and positive feedback on planning games than on deduction/categorization games. On the arrangement planning games, overall pedagogical interactions were important, but none of the specific styles was individually important. (MDM)

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Exploring Parental Influences on Children's Problem-Solving Skills

by

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Abstract

This study investigated how parental teaching and communication styles of families around O'ahu covary with children's performance on four problem-solving games involving deduction/categorization and planning (2 games/strategy). Participants were 32 families with children 4-5 years old, half girls and half boys. Videotaped home-visits consisted of an individual-play pre-test, a parent partner phase, and an individual-play post-test. Children played one deduction/ categorization and one planning game with their parents. There was a benefit associated with parental partnership for both game types. Overall pedagogical interactions were related to planning. Strategic explanation, strategic direction, and positive feedback, were related to deduction/categorization. Parents exhibited more metacognitive instruction, and positive feedback on planning than on deduction/categorization games. Data indicate that different kinds of parental interaction benefit children's problem-solving, depending upon the type of strategy and difficulty level involved in a task.

Introduction

The present study examined the impact of different styles of parental communication and teaching on children's problem-solving. While children must invent their own solutions to problems (Siegler, 1991), the strategies by which they do say may originate in social interactions with adults (Mullis & Mullis, 1986). We focused on how parental explanation and direction in strategy use, metacognitive instruction, and positive feedback related to children's performance on two types of games. One type of game required planning arrangements, and the other deduction - using - categorization.

Previous research (Baker & Brown, 1984; Brown & Barclay, 1976; Martini, 1995; Pérez-Granados & Callanan, 1997; Siegler, 1991; Sumner & Spietz, 1994; Wood, 1989) led us to generate the following hypotheses:

- Parental interactions containing metacognitive instruction, explaining strategies, and positive feedback would be positively related to children's scores.
- Directive instruction would not be related, or relate negatively to children's independent performance.
- The combination of these four measures would correlate positively with children's post-test performance.

Method

Subjects

- *N* = 32 children & their families from around O'ahu
- Children's ages = from 4 to 5 years old
- Equal numbers of boys & girls
- Equal numbers of parents born in Hawai'i or mainland U.S.
- English was the first language

Procedure

Parents were told that this was a study on how children learn from their parents. We visited the families, in their homes, one time for approximately two hours.

During the first phase, as a pre-test, the child played each of four games by him/herself. All games were introduced, explained, and demonstrated. The child was checked for understanding. If the child did not obtain the solutions he/she was shown the correct response.

After the pre-test the parents were invited to play as *partners* with the child on one planning arrangement game and one deduction/ categorization game. The only instructions given were to clarify that parental manipulation and engagement with the games and consultation between parent and child was appropriate. No restrictions were placed on which other family members could participate with the child. The parents and child played each game four times.

The final activity for the child, the "post-test," was to play each game again unassisted using the same format as in the initial game presentation.

Materials and Equipment

- Unique games were developed to reduce biases and insure game amenability to instruction in strategies
- Note the Special Counter used to visually keep track of the number of questions allowed. Each game had a limited number of moves and at the conclusion the child received a sticker for each move not used
- All games were video-taped

Coding

The video-tapes were transcribed, and parent-child interactions were segmented into units and coded according to the modality of communication and whether or not they involved the use of strategy. All interactions were then assigned to one of seventeen qualitative descriptors of the function of the interaction. From these we selected codes which fit into the following four pedagogical interaction categories:

- Metacognition instruction
- Explanatory instruction (strategic)
- Directive instruction (strategic)
- Positive feedback interactions

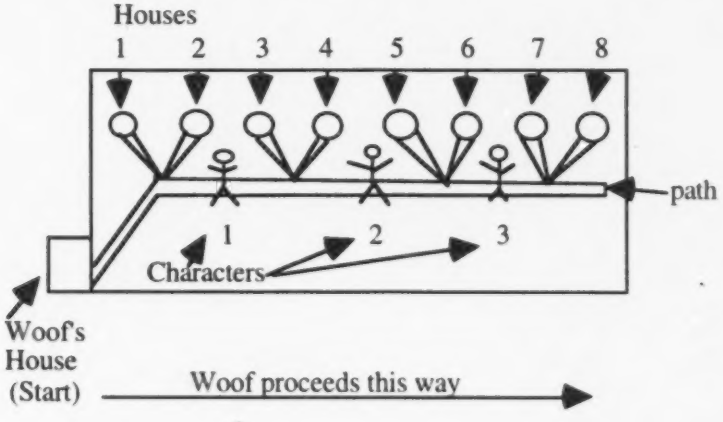
Inter-rater reliabilities, calculated as the ratio of agreements to the total number of codes, ranged from 88.85% to 97.04% with an average of 92.73%.

The number of instances of communication modalities, strategic and non-strategic interactions, and metacognitive instruction, strategic explanatory instruction, strategic directive instruction, and positive feedback were compared to the total number of codable interactions to obtain percentages.

The Games

"Woof" is a dog who likes to play, so he is always leaving his doghouse on the West-end of his neighborhood and traveling East to visit in one of the eight houses along the path. Since the child also would like to play with Woof, it is the child's task to find him. Three neighbors along the path serve as friendly "guides" ready to determine Woof's general route. The child can ask up to seven "yes" or "no" questions of the guides and/or the "people" in the houses - the fewer questions asked, the better the score, but random guessing always results in a score of zero.

GAME BOARD FOR WOOF



"FLIP-CHART-STYLE" COUNTER FOR TURNS IN GAME – #s 1 to 7

USED IN ALL GAMES

"Seven Questions" required two identical sets of eight picture cards of differently colored items. In determining which **one** card the experimenter had "in mind" the child could use only "yes" or "no questions. The items could be categorized based upon functional and/or perceptual attributes, such as living or non-living, land or water objects, etc. The child was allowed seven questions, the number remaining when the child found the answer were the score. To eliminate *guessing* the experimenter did not actually choose the card. Instead, she answered questions depending upon which ruled out the least number of cards; the solution was adjusted until only two items remained. If the child randomly guessed the experimenter did not say "yes" until the final question.

OBJECTS ON PICTURE CARDS:

Cat (brown)	Truck (green)
Horse (black)	Body board (orange)
Dolphin (gray)	Bicycle (red)
Fish (blue)	Rowboat (purple)

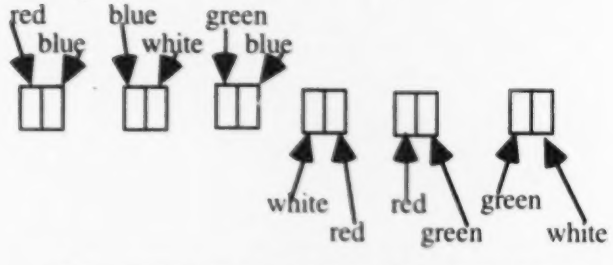
"Bears 'n Hats," is a non-spatial planning task. The child is asked to place six small bears or hats, of different colors, onto six bi-colored placement objects. The placement objects were colored with two of the four colors represented by the assortment of bears and hats; each color was present on three of each of the four types of placement objects. The bears/hats had to match one of the colors of the placement. Four different placement objects -- small boxes, surfboards, picnic mats, and wooden dolls -- were used to reduce utility of memorization in game performance. Availability of colors was also varied.

OBJECTS USED FOR PLACEMENT: Boxes, Surfboards, 1" Wooden Dolls, Picnic Mats

OBJECTS USED FOR PLACING: Plastic Bears (to be placed on all but dolls); Straw Hats (to be placed on dolls)

FOR EXAMPLE: Boxes & Bears

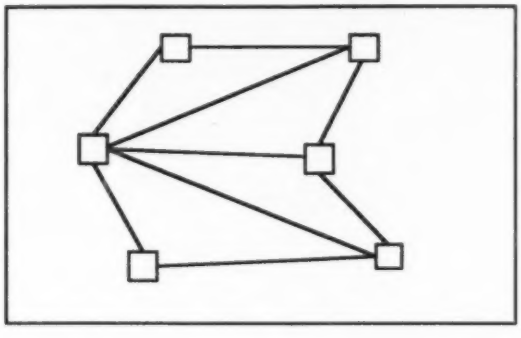
PLACEMENTS ARE PAINTED WITH 2 COLORS EACH
Boxes:



OBJECTS FOR PLACEMENT ARE 1 COLOR EACH
(i.e. bears are solid red, blue, white, or green)

In **"Configurations,"** the child puts six blocks of three colors (3 of one color, 2 of another, & 1 of a third) on six blank squares connected by lines. The objective is to have none of the same-colored blocks connected. Up to six corrective moves are allowed (removal of a block from a square or clearing all blocks from the board). The fewer corrections, the better the score! Eight different patterns and varied block colors are used to reduce memorization.

SAMPLE GAME BOARD PATTERN
(Eight differently configured patterns are used)



RESULTS

Figure 1. On the partnered games, significantly more children improved as compared to the number who regressed. The benefit did not generalize to children's performance on non-partnered games of the same types, where children were as likely to decrease as to increase. The large number of children with no change in scores does indicate that the games were challenging, especially DC games.
(DC = Deduction/Categorization, PA = Planning Arrangement).

Table 1. To determine how four sets of measures of parental teaching and communication styles related to children's change in performance on the games, four discriminant function analyses were used. The alpha level was adjusted to 0.0167 due to the multiple analyses.

Figure 2. Children who increased from pre- to post-tests had on average received more overall pedagogical interactions than children who decreased or showed no change in performance.

Figure 3. Children who increased from pre- to post-test had on average received more explanatory and metacognitive instruction than those who decreased or those who showed no change in performance. Compared to children who decreased or who showed no change, children who increased received an intermediate amount of direction and positive feedback.

Figure 4. To determine if parents were behaving differently or had different goals on the games involving the different strategies, an ANOVA, designed as a 3 (goals: instructional, supportive, combined) x 2 (strategy-type: deduction/categorization, arrangement planning) x 4 (pedagogical interaction category: metacognitive, explanatory, and directive instruction, and positive feedback) was conducted. Parents' goals did not differ across games, but behavior did [$F(3, 87) = 4.67$, $p < .005$]. Comparing means of pedagogical interaction categories, parents exhibit statistically more positive feedback and metacognitive instruction on arrangement planning games than on deduction/categorization games.

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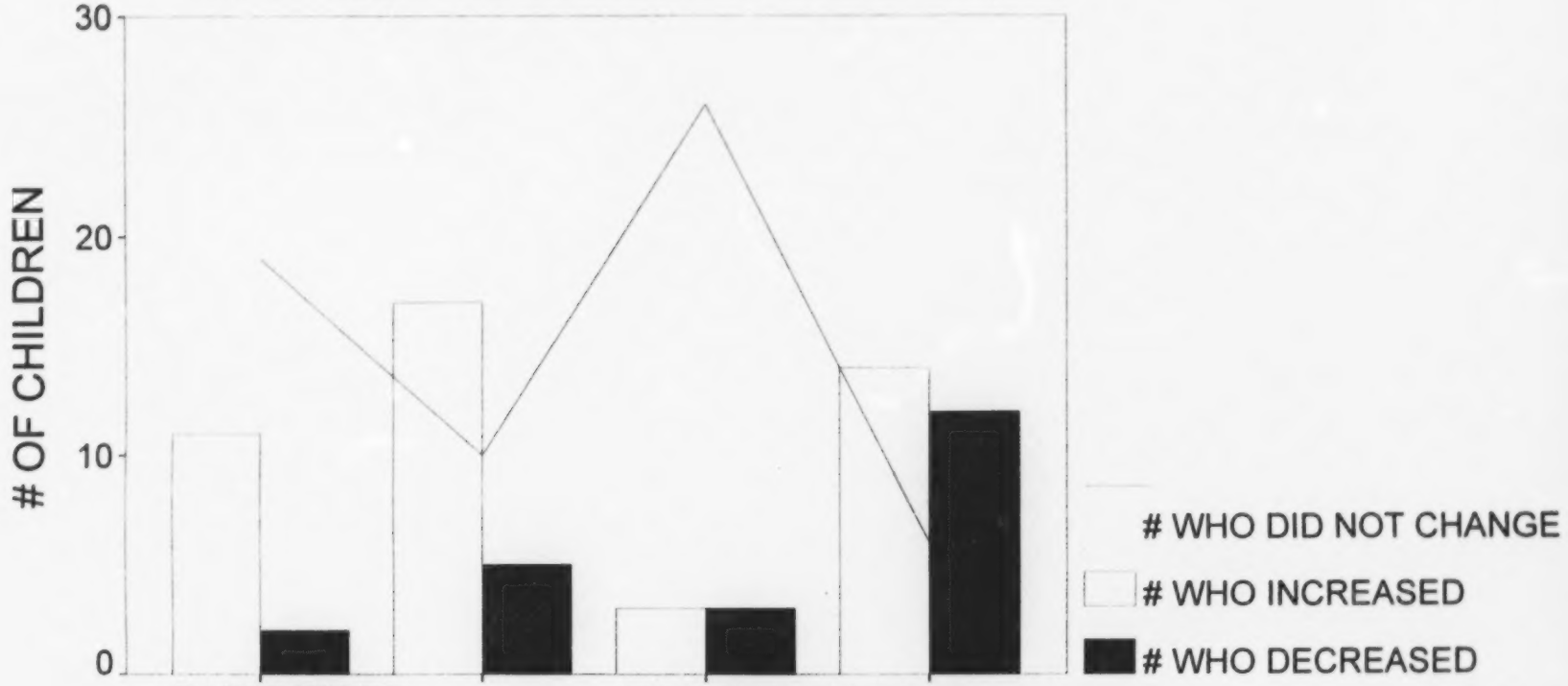
Figure 1

Binomial Comparisons of Pre- to Post-Test Changes in Children's Performance:

Game Type and Parental Partnership



PARTNERED
DC GAMES
$p < .02$

PA GAMES
$p < .01$

NON-PARTNERED
DC GAMES
$p < .66$

PA GAMES
$p < .43$

STATISTICAL RESULTS OF DISCRIMINANT FUNCTION ANALYSES

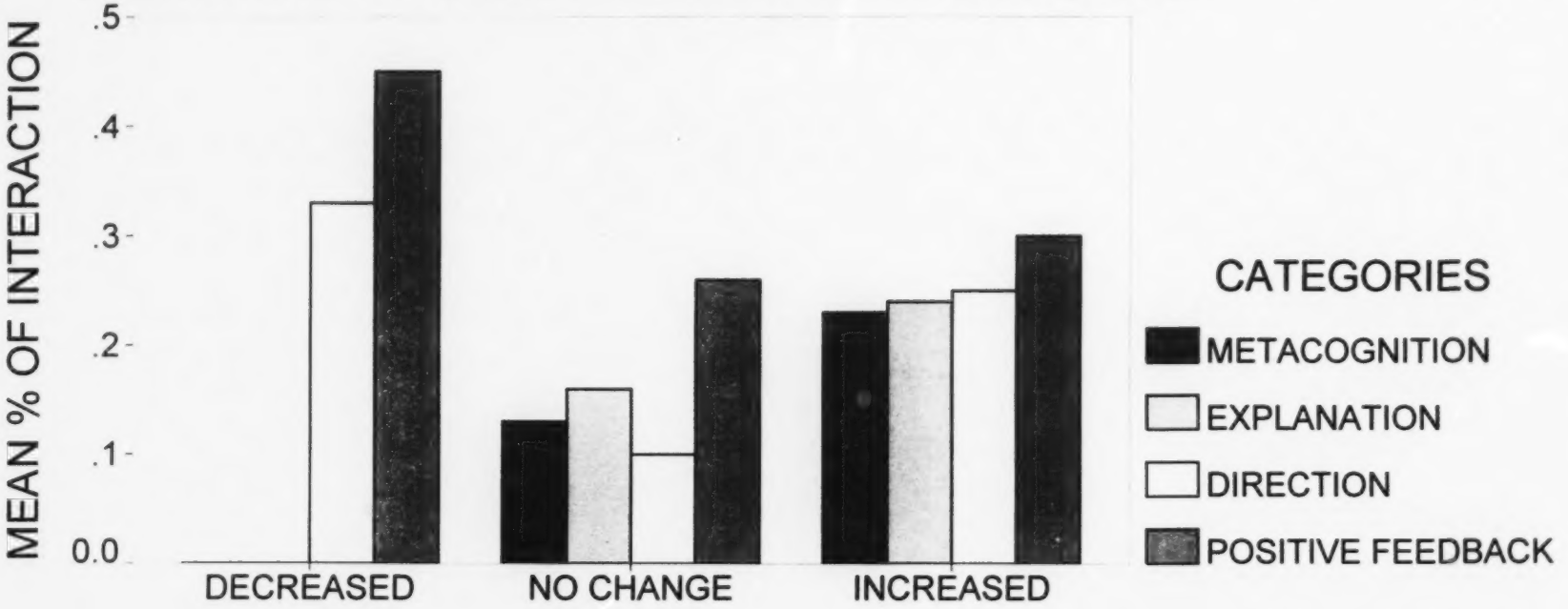
PLANNING	ARRANGEMENT	PARENTAL MEASURES	DEDUCTION/	CATEGORIZATION
Overall pedagogical interactions are significantly related to children's performance.	8.21 (df = 2, N = 32) .0167 .50 25% 1 .90	Overall Pedagogical Interaction p < Canonical Correlation Variance Accounted For # of Independent Variables Power	6.46 (df = 2, N = 32) .05 .45 20% 1 .80	Overall pedagogical interactions only tend towards a systematic relation.
No systematic relations are present for the use of	4.57 (df = 6, N = 32) .65	Modality of Communication p <	8.72 (df = 6, N = 32) .20	The use of strategy & modality of communication are
strategy nor the modality of communication in interactions.	7.28 (df = 4, N = 32) .15	Strategy Use in Interaction p <	9.35 (df = 4, N = 32) .06	not associated with performance.
Only a trend of association exists for the four pedagogical interaction categories.	16.04 (df = 8, N = 32) .05 .63 40% 4 .91	Pedagogical Interaction Categories p < Canonical Correlation Variance Accounted 4 # of Independent Variables Power	20.71 (df = 8, N = 32) .0167 .61 37% 4 .91	The four pedagogical interaction categories are significant predictors of performance.

Parental Overall Pedagogical Interactions on Planning Arrangement Games:

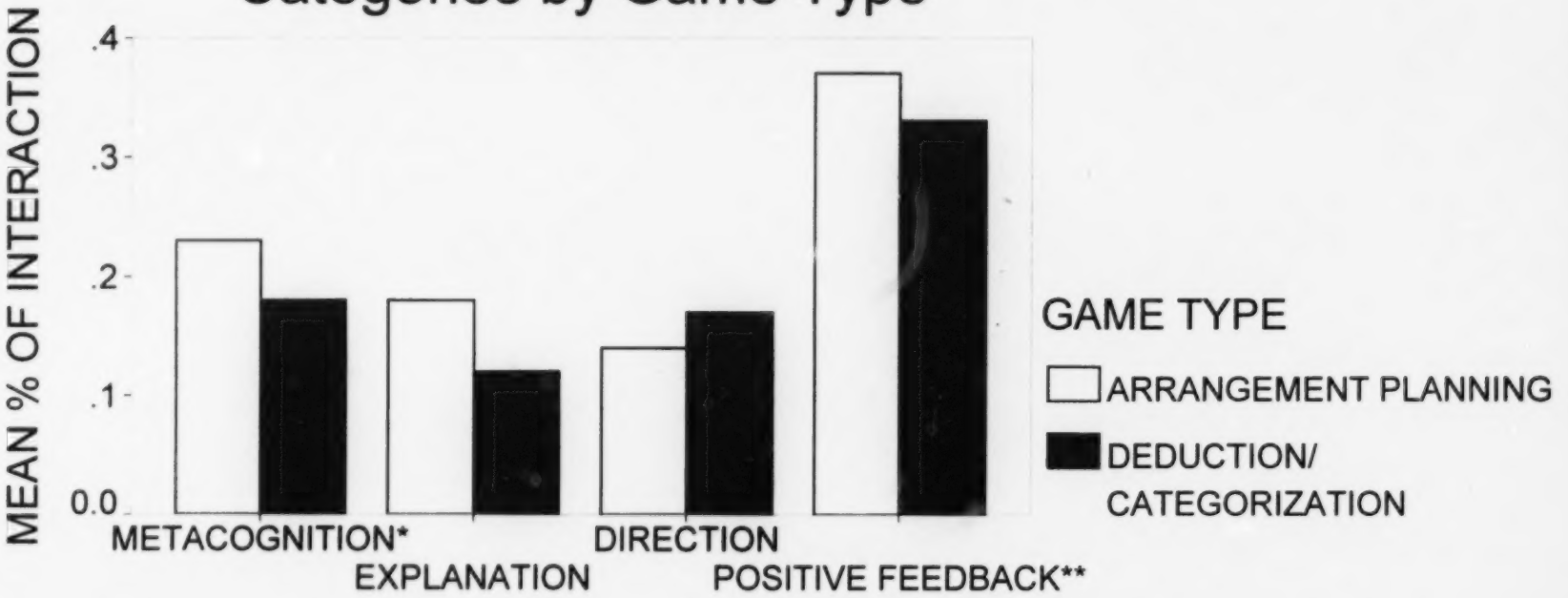
Relation with Changes in Children's Performance

Parental Pedagogical Interaction Categories on Deduction/Categorization Games:

Relation with Changes in Children's Performance



Differences in Pedagogical Interaction Categories by Game Type



* F (1, 29) = 5.74, p < .02

** F (1,29) = 4.07, p < .05

Discussion

HYPOTHESIS #1: PARENTAL INTERACTIONS CONTAINING METACOGNITIVE INSTRUCTIONS, EXPLAINING STRATEGIES, AND POSITIVE FEEDBACK ARE POSITIVELY RELATED TO CHILDREN'S SCORES.

– Partially supported by the results for deduction/categorization games. As parental metacognitive instruction and strategic explanation increases, so do children's post-test scores as compared to their pre-test scores. The relation for positive feedback is different,

as children who improved on the post-test have parents who used an intermediate amount.

– Not supported in arrangement planning games.

HYPOTHESIS #2: DIRECTIVE INSTRUCTION IS NEGATIVELY, OR NOT AT ALL RELATED TO CHILDREN'S INDEPENDENT PERFORMANCE.

– Holds for A games.

– in DC games. Children who improved on the post-test had parents who exhibited an intermediate amount of strategic direction.

HYPOTHESIS #3: THE COMBINATION OF THESE FOUR MEASURES IS CORRELATED POSITIVELY WITH CHILDREN'S POST-TEST PERFORMANCE.

– Supported in arrangement planning games.

– Not supported for deduction/categorization games.

Together, the evidence indicates that different kinds of parental interaction benefit children's immediately subsequent performance of planning and deduction/ categorization skills. On the deduction/categorization games, which children found more difficult, specific styles of parental pedagogical interaction, especially directive instruction, are important. On the arrangement planning games, at which children already had some skill, overall pedagogical interactions are important, but none of the specific styles are individually important. It is possible that a particular balance between metacognitive instruction, strategic explanation, strategic direction,

and positive feedback, the particulars of which are shaped by the kind of strategy and its difficulty level for the child, is the most effective in promoting problem-solving performance.

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